

GHG Inventory in LULUCF sector

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GHG Inventory for LULUCF

- NATCOM-I
 - Inventory prepared for 1994
 - Methods – IPCC 1996 revised guidelines
- NATCOM-II
 - Inventory being prepared for 2004
 - Methods- IPCC 2003 GPG for LULUCF
- Institutions involved
 - IISc, ICFRE, FSI, FRI, NRSC, IIRS...

Emission inventory – LULUCF in Gg

For year 1994 (IPCC, 1996 Guidelines)

Greenhouse Gas Source and Sink Categories	CO ₂ emissions	CO ₂ removals	CH ₄	N ₂ O	NO _x	CO
5.A CO ₂ emissions from changes in forest and other woody biomass stocks		14252				
5.B CO ₂ emissions from forest and grassland conversion	17987					
5.C CO ₂ uptake from abandonment of managed lands		9281				
5.D CO ₂ emissions from agriculturally impacted soils	19687					
Total CO ₂ emissions/removal	37674	23533				

Net emissions from LULUCF sector: 1.4 million tons for 1994

Why GPG approach

- UNFCCC recommends adoption of IPCC 2003 GPG approach to LULUCF
- *GPG is Land use categories*: Adopted 6 land categories to ensure consistent representation, covering all geographic area of a country.
 - *Forestland, cropland, grassland, wetland, settlements and others*
- Each land use category is further disaggregated to reflect the past and the current land use
 - *Forestland remaining forestland*
 - *Lands converted to forestland*
- **Links Biomass carbon with Soil Carbon**
- CO₂ emissions and removal is estimated for all the C-pools namely;
 - *Aboveground biomass*
 - *Belowground biomass*
 - *Soil carbon*
 - *Dead organic matter and woody litter*
- **Non-CO₂ gases estimated include; CH₄, N₂O, CO and No_x**

Reporting of GHG Inventory in the LUCF Sector – GPG2003

Greenhouse gas source and sink categories	IPCC guidelines	Net CO ₂ emissions / removals ⁽¹⁾	CH ₄	N ₂ O	NO _x	CO
		(Gg)				
5. Total Land-Use Categories						
5.A. Forest Land						
5.A.1. Forest Land remaining Forest Land	5A					
5.A.2. Land converted to Forest Land	5A, 5C, 5D					
5.B. Cropland						
5.B.1. Cropland remaining Cropland	5A, 5D					
5.B.2. Land converted to Cropland	5B, 5D					
5.C. Grassland						
5.C.1. Grassland remaining Grassland	5A, 5D					
5.C.2. Land converted to Grassland	5C, 5D					
5.D. Wetlands ⁽²⁾						
5.D.1. Wetlands remaining Wetlands	5A, 5E					
5.D.2. Land converted to Wetlands	5B, 5E					
5.E. Settlements ⁽²⁾						
5.E.1. Settlements remaining Settlements	5A					
5.E.2. Land converted to Settlements	5B, 5E					
5.F. Other Land ⁽²⁾						
5.F.1. Other Land remaining Other Land	5A					
5.F.2. Land converted to Other Land	5B, 5E					
5.G. Other (please specify) ⁽²⁾						
<i>Harvested Wood Products ⁽²⁾</i>						

Methods

- Land Categories and land use and land Use change Matrix
 - Forest land by FSI
 - Other land categories and land use change matrix by NRSC
- Biomass Carbon and Soil Carbon
 - Forest land by ICFRE, FRI and IIRS
 - Other 5 land categories by IISc (Literature and field studies)
- ROTH-C model for Soil Carbon Estimates
- Methods: Tier 2 and Tier 3

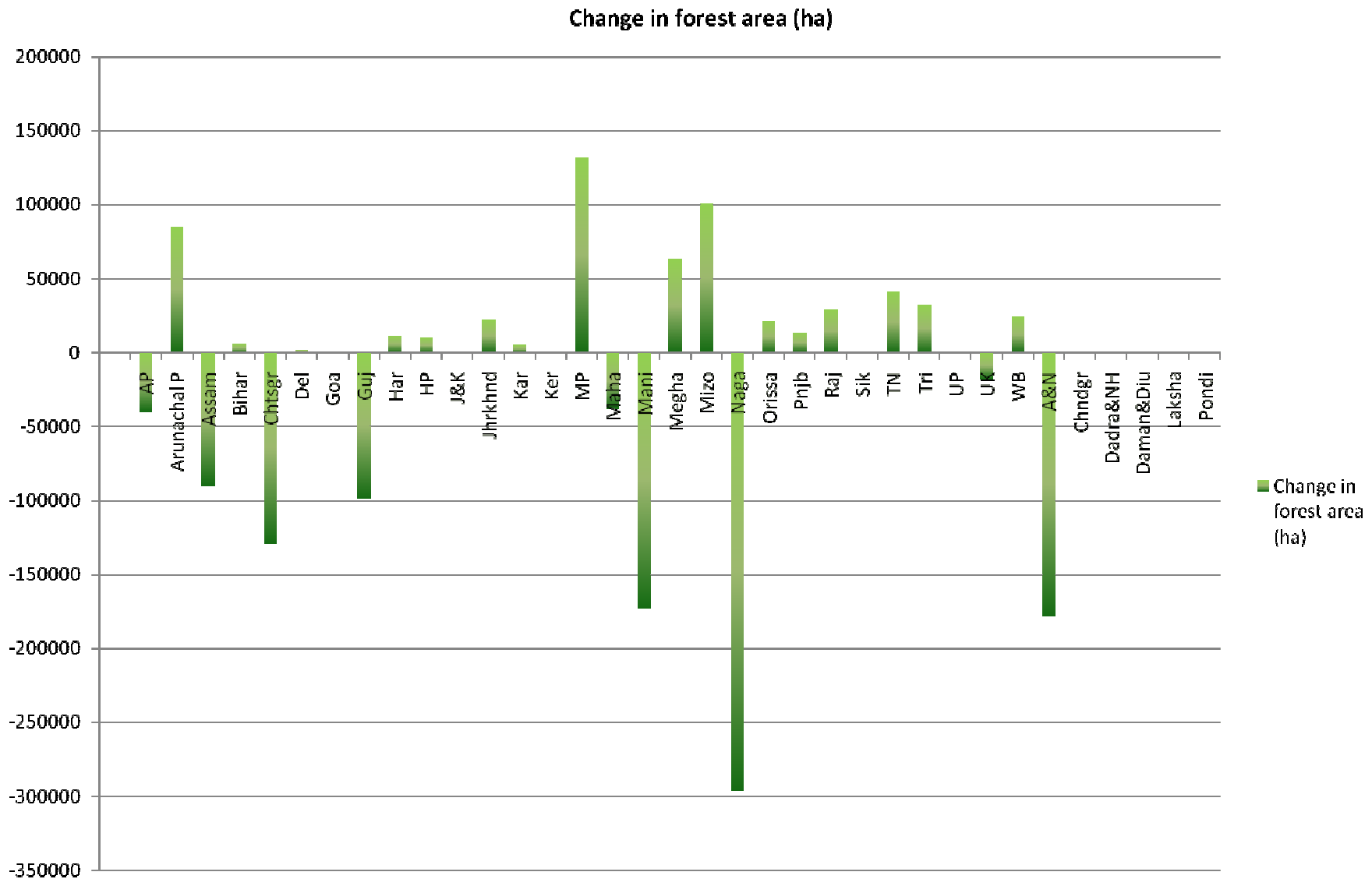
Current Status

- Forest land – ICFRE and FSI will present the results
- **Other land categories** (CL,FL,WT,ST,OL)
 - Land Use data and Land Use change matrix under preparation by NRSC
 - Biomass and soil carbon data – Being collected by IISc team from literature and field studies
- Inventory to be ready by early next year
- **Very crude preliminary estimates presented here**

Land Categories and Land Use

Land use category	Area(m ha)		
	1994	2000	2004
Forest Land	63.96	67.55	67.78
Cropland	142.96	141.23	140.945
Grassland (Permanent pastures and other grazing lands+culturable wasteland+fallow land)	49.581	49.883	49.076
Wetlands (natural and man-made)	3.5	4.04	NA
Settlements (urban & rural)	16.389	17.057	21.499
Other lands (snow & ice-covered areas, desert, rocky and hilly areas)	52.34	48.97	49.43
Country Total Geographical area	328.73	328.73	328.73

Average Change in Forest Area during 2004 in different states – Estimates based on Area under forest in 2003 and 2005 (FSI data)



Biomass Stock Change: Land remaining in the same category

Land use	Area (in m ha)	Biomass growth rate (in Mt)	Annual rate of change (t/ha/yr)
Forest Land	67.78	17.32	0.255532605
Cropland	140.945	46	0.326368442
Grassland	49.076	19.6	0.399380553

SOC Stock change

Land use	Area (in m ha)	SOC growth rate (t/ha)	Annual rate of change (t/ha/yr)
Forest Land	67.78	22.805	0.34
Cropland	140.945	26.06	
Grassland	49.076	181.87	0.18

Rate of change in Biomass & SOC due to Land use change

Land-use change category	Area	Rate of change of biomass (t/ha/yr)	Rate of change of SOC (t C/ha/yr)
Land converted to forest land	298500	1.66	0.3
Forest land converted to other land	-232000	40.95	
Cropland converted to other land	-201500	0.16	0.11
Grassland converted to other land	-50500		

GHG emissions/removals from LULUCF sector

Land-use category	Land-use change category	Carbon emissions/removals (MtC)	
		Biomass	SOC
Forest land	Forest land remaining forest land	16.94	20.33
	Land converted to forest land	0.49	0.09
	Forest land converted to other land	-9.5	IC
Cropland	Cropland remaining cropland	22.55	15.50
	Land converted to cropland	-	-
	Cropland converted to other land	IC	-0.02
Grassland	Grassland remaining grassland	9.81	37.78
	Land converted to grassland	-	-
Wetland	Wetland remaining wetland	IC	IC
	Land converted to wetland	IC	IC
Settlements	Settlements remaining Settlements	IC	IC
	Land converted to Settlements	IC	IC
Other lands	Other lands remaining Other lands	IC	IC
	Land converted to Other lands	IC	IC
Total	Net emissions and removal	40.30	73.69

Plan of work

Work	Deadline
Field studies for biomass and soil carbon	Oct-Nov
Laboratory studies for soil carbon	Oct-Nov
Synthesis of Inventory Report	Dec 2009
Peer review	Jan-Feb 2010
Workshop	March 2010